

In the Claims

1. (canceled) An interventional device comprising:
an elongate body, having a distal end and a proximal end, and having at least one internal lumen within said body for supplying fluid, said fluid supplied being called a primary fluid;
a cap and a nubbin which together define a narrow gap between the nubbin and the cap for directing fluid out of said elongate body at high velocity and at an approximately acute angle with respect to said elongate body;
said nubbin having a nubbin wall located adjacent said gap;
said nubbin wall providing an asymmetrical wall surface exposed to the primary fluid as it emerges from said gap;
whereby a primary fluid exiting the gap attaches to the nubbin wall surface of the nubbin and entrains a secondary flow of fluid which moves in an approximately retrograde direction towards said proximal end.
2. (canceled) The interventional device of claim 1 further including:
a delivery sheath having a lumen said lumen having a first diameter.
3. (canceled) The interventional device of claim 2 wherein said nubbin has a second diameter less than said first diameter.
4. (canceled) The interventional device of claim 3 wherein said gap has a third diameter less than said second diameter, such that said nubbin forms a wall adjacent said gap.

5. (canceled) The interventional device of claim 2 wherein said sheath and said elongate body may be moved with respect to each other.

6. (canceled) The interventional device of claim 2 wherein said sheath and said elongate body are fixed with respect to each other.

7. (amended) A method of removing particulate debris from a vessel using a catheter assembly the method comprising:

inserting and advancing a sheath having a discharge lumen to a location in the vessel said delivery sheath discharge lumen coupled to a collection vessel; said sheath not having an occlusion balloon thereon such that said sheath partially blocking the vessel but allowing some blood flow in the vessel;

inserting and advancing an interventional device to a treatment location said interventional device of type having;

an angioplasty therapy balloon for delivering angioplasty treatment;

a gap for introducing a primary fluid flow in said vessel, said gap located distal of said therapy balloon;

injecting fluid out of said gap to promote retrograde flow into said discharge lumen.

8. (previously amended) The method of claim 18 wherein said moving step begins near said occlusion and ends after the interventional device enters the delivery sheath.

9. (previously amended) The method of claim 7 wherein said fluid is injected at a first injection pressure above the blood pressure in the vessel and expands to a second exhaust pressure in said delivery catheter where said exhaust pressure is above said blood pressure, establishing a pressure gradient in said discharge lumen and promoting flow from said gap to said discharge lumen.

10. (canceled) An interventional device comprising:
an elongate body having a fluid supply lumen and having an inflation lumen:
a slit located in said elongate body communicating with said fluid supply lumen
permitting fluid to emerge from said fluid supply lumen at an angle with respect to said
elongate body;
a nubbin located adjacent said slit; said nubbin providing a wall surface near the
slit such that fluid emerging from the slit adheres to the wall of the nubbin and flows
along the wall surface;
a balloon located distal of said slit in communication with said inflation lumen.

11. (canceled) An interventional device comprising:
an elongate body having a fluid supply lumen and having an inflation lumen:
a slit located in said elongate body communicating with said fluid supply lumen
permitting fluid to emerge from said fluid supply lumen at an angle with respect to said
elongate body;
a nubbin located adjacent said slit; said nubbin providing a wall surface near the
slit such that fluid emerging from the slit adheres to the wall of the nubbin and flows
along the wall surface;
a balloon located proximal of said slit in communication with said inflation
lumen.

12. (canceled) An interventional device comprising:
an elongate body having a fluid supply lumen and having an inflation lumen:
a slit located in said elongate body communicating with said fluid supply lumen
permitting fluid to emerge from said fluid supply lumen at an angle with respect to said
elongate body;
a balloon located distal of said slit approximately adjacent said slit and said
balloon in communication with said inflation lumen;
whereby said balloon provides a wall surface near the slit such that fluid
emerging from the slit adheres to the wall of the balloon and flows along the wall
surface of the balloon.

13. (canceled) The interventional device of claim 12 further comprising:

a second therapy balloon proximal of said first balloon.

14. (canceled) The interventional device of claim 13 wherein said second therapy balloon is an angioplasty balloon.

15. (canceled) The interventional device of claim 13 wherein said second therapy balloon is a stent placement balloon.

16. (canceled) The interventional device of claim 11 wherein said balloon is a stent placement balloon.

17. (canceled) The interventional device of claim 11 wherein said balloon is an angioplasty balloon.

18. (previously added) The method of claim 7 wherein said injection is carried out while moving said interventional device in said vessel with respect to said delivery sheath.

19. (previously added) The method of claim 7 wherein said discharge lumen is coupled to a syringe collection chamber.

20. (previously added) The method of claim 7 wherein said discharge lumen is coupled to a syringe vacuum chamber.

21. (previously added) The method of claim 7 wherein said primary fluid is supplied by a supply syringe chamber.

22. (previously added) The method of claim 21 wherein the fluid supplied is a thrombolytic.

23. (previously added) The method of claim 21 wherein the fluid supplied is saline.

24. (previously added) The method of claim 21 wherein the fluid supplied is contrast agent.

25. (canceled) The method of claim 7 wherein the therapy balloon provides angioplasty therapy.

26. (canceled) The method of claim 7 wherein the therapy balloon provides stent placement therapy.

27. (previously added) The method of claim 7 wherein said primary fluid is supplied by a supply syringe chamber and said discharge lumen is coupled to a syringe vacuum chamber, and said supply syringe and vacuum syringe are operated together to couple fluid supply with discharge lumen collection.

28. (amended) A method of removing particulate debris from a vessel using a catheter assembly the method comprising:

inserting and advancing a sheath having a discharge lumen to a location in the vessel said delivery sheath discharge lumen coupled to a collection vessel; said sheath not having an occlusion balloon thereon such that said sheath partially blocks the vessel but allowing some blood flow in the vessel;

inserting and advancing an interventional device to a treatment location, said interventional device of type having;

a stent deployment therapy balloon for delivering stent treatment;

a gap for introducing a primary fluid flow in said vessel, said gap located distal of said therapy balloon;

injecting fluid out of said gap to promote retrograde flow into said discharge lumen.

30. (previously added) The method of claim 7 further including a suction applied to said sheath lumen to withdraw material form said vessel.

31. (previously added) The method of claim 29 further including a suction applied to said sheath lumen to withdraw material form said vessel.